ment. A significant increase in tAB was observed over 27 months in most cartilage plates. The increase in femoral, but not in tibial subchondral bone areas, displayed a statistically significant relationship with knee alignment. These data suggest that the size of the subchondral bone areas adapts to the individual mechanical loading situation, potentially in an effort to keep mechanical stresses (load/area) balanced between the medial and lateral knee compartment.

Young Investigator Travel Award Winner

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CARTILAGE THICKNESS CHANGES IN THE KNEE OVER 1 YEAR AND ASSOCIATED RISK FACTORS - DATA FROM THE OSTEOARTHRITIS INITIATIVE PROGRESSION SUBCOHORT

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Purpose: The Osteoarthritis Initiative (OAI) is a multi-center, prospective cohort study targeted at identifying sensitive biomarkers for evaluating the development and progression of symptomatic knee OA, and at identifying risk factors of OA. Here we analyze longitudinal data from a subset of the OAI to examine whether changes in cartilage morphology are observed over 1 year using 3 Tesla MRI, and whether risk factors for cartilage loss can be identified.
Methods: An age and gender stratified subsample of the OAI progression subcohort (n = 156, 79 women, 77 men, age 60.9 $\pm$ 9.9 y., BMI 30.3 $\pm$ 4.7) with frequent symptoms and radiographic OA in at least one knee was studied (OAI public-use datasets 0.1.1, 0.B.1 and 1.B.1). 1.5mm coronal FLASHwe MR images of all right knees were acquired using 3T Siemens Trio scanners. A team of 7 experienced readers segmented medial/lateral tibial (MT/LT) and medial/lateral weight-bearing femoral (cMF/cLF) cartilages blinded to order of acquisition. All segmentations were quality controlled by one reader. Cartilage volume (VC) and the mean cartilage thickness over the entire subchondral bone ((ThC) were computed using proprietary software (Chondrometrics GmbH, Ainring, Germany). The mean change, SD of change, standardized response mean (SRM = mean change/SD) and the significance of change (paired t-test, without correction for multiple testing) were calculated. Multifactorial ANOVA for categorical and general linear models (GLM) for continuous variables were used to test main and interaction effects, in order to identify potential risk factors of cartilage loss.
Results: The reduction in cartilage volume (VC) and thickness (ThC) were relatively small (Table 1). In the medial compartment, changes in ThC of cMF ($p<0.001$) exceeded those in MT ($p<0.05$), and in the lateral compartment reductions in LT ($p<0.01$) exceed those in cLF ($p>0.05$) (Table 1).The SRMs for cartilage thickness (ThC) were generally higher than those for cartilage volume (VC). Multifactorial ANOVA did not reveal significant differences in the rate of change by sex, frequent symptoms (n=108, vs. 48 without), K/L grade 2-4 (n=110, vs. 46 K/L 0-1), or BMI >30 (n=79, vs. 77 <30) as categorical variables. Also, no significant differences in the rate of change were detected for age and BMI analyzed as continuous variables. As a trend, participants with ROA (K/L grade 2-4) tended to display greater changes than those without, and participants with a BMI >30 greater changes than those with a BMI <30 (Table 1). The greatest changes (-4.1%; SRM =-0.49 for ThC of cMF) were observed in a subcohort with K/L 2-3 radiographic OA and obesity (Table 1).
Conclusions: Modest changes were observed in this small sample of the OAI cohort. It should be noted, however, that the sample analyzed included some knees that did not display symptoms or radiographic OA at baseline. Knees with radiographic OA in obese persons showed trends towards higher rates of change than the entire cohort. However a larger sample is needed to determine whether these risk factor are statistically significant.

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AUTOMATED OBJECTIVE SCORING OF CARTILAGE HISTOLOGY

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Purpose: Histologic assessments of cartilage specimens are often used to grade for osteoarthritis severity, with the most widely used instrument being the histological/histochemical grading scale (HHGS) devised by Mankin et al. On this scale, cartilage is graded on structural compromise (0-6), cationic staining (0-4), cellularity (0-3), and violation of tidemark integrity (0-1). Heretofore, HHGS scoring has been dependent on human observer subjectivity, and thus prone to inter- and intra-observer variability. This study reports a newly developed image analysis program for automated, objective implementation of Mankin HHGS grading. Scores generated by the computer program are compared to scores assigned by 7 trained observers.
Methods: To quantify cartilage structural damage, baseline datum for the "jagged" osteoarthritic cartilage surface is established by smoothed quadratic curve fits. Cleft/defect depths are calculated by finding the distance between the smoothed (datum) quadratic curve fits and the actual cartilage surface. The measured cleft/defect depths are divided by cartilage thickness, defined by the smooth quadratic surface curve and a corresponding smoothed curve representing the osteochondral boundary.
Cartilage proteoglycan (PG) content, visualized by the cationic stain safranin-O, is quantified using the hue component of the Hue-Saturation-Brightness (HSB) color model, to select near-red pixels representing cartilage PG-positive region. After recognizing these pixels, the program calculates the average saturation (again, by HSB) of these near-red pixels, while also assigning zero saturation values to non-red cartilage pixels.

Abstract 300 – Table 1. Mean change (MC) in % and SRM in femorotibial cartilage plates over 1 year

		Medial Tibia		Med.Femur		Lateral Tibia		Lat. Femur	
		MC	SRM	MC	SRM	MC	SRM	MC	SRM
All (n = 156)	VC	-0.4%	-0.12	-1.5%	-0.21	-0.6%	-0.17	0.0%	0.01
All (n = 156)	ThC	-0.5%	-0.16	-1.9%	-0.30	-0.7%	-0.23	0.1%	0.02
Symptoms (n = 108)	ThC	-0.3%	-0.07	-2.1%	-0.30	-0.7%	-0.22	-0.1%	-0.03
K/L 2-4 (n = 110)	ThC	-0.6%	-0.15	-2.4%	-0.32	-0.9%	-0.30	0.1%	0.02
Obesity (n = 79)	ThC	-0.8%	-0.22	-2.8%	-0.39	-1.0%	-0.37	0.1%	0.01
K/L 2-3 + Obesity (n = 54)	ThC	-1.0%	-0.24	-4.1%	-0.49	-1.1%	-0.39	0.1%	0.03